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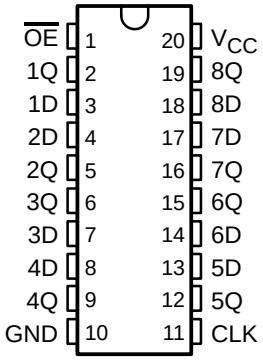
Jameco Part Number 214210

SN54AHC374, SN74AHC374 OCTAL EDGE-TRIGGERED D-TYPE FLIP-FLOPS WITH 3-STATE OUTPUTS

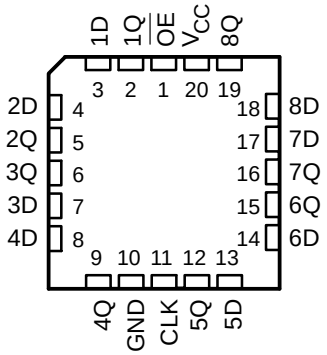
SCLS240H – OCTOBER 1995 – REVISED FEBRUARY 2002

- **Operating Range 2-V to 5.5-V V_{CC}**
- **3-State Outputs Drive Bus Lines Directly**
- **Latch-Up Performance Exceeds 250 mA Per JESD 17**
- **ESD Protection Exceeds JESD 22**
  - **2000-V Human-Body Model (A114-A)**
  - **200-V Machine Model (A115-A)**
  - **200-V Charged-Device Model (C101)**

SN54AHC374 . . . J OR W PACKAGE
SN74AHC374 . . . DB, DGV, DW, N, NS, OR PW PACKAGE
(TOP VIEW)



SN54AHC374 . . . FK PACKAGE
(TOP VIEW)



description

The ’AHC374 devices are octal edge-triggered D-type flip-flops that feature 3-state outputs designed specifically for driving highly capacitive or relatively low-impedance loads. These devices are particularly suitable for implementing buffer registers, I/O ports, bidirectional bus drivers, and working registers.

On the positive transition of the clock (CLK) input, the Q outputs are set to the logic levels of the data (D) inputs.

A buffered output-enable ($\overline{OE}$) input can be used to place the eight outputs in either a normal logic state (high or low) or the high-impedance state. In the high-impedance state, the outputs neither load nor drive the bus lines significantly. The high-impedance state and the increased drive provide the capability to drive bus lines without interface or pullup components.

$\overline{OE}$ does not affect internal operations of the flip-flop. Old data can be retained or new data can be entered while the outputs are in the high-impedance state.

To ensure the high-impedance state during power up or power down, $\overline{OE}$ should be tied to V_{CC} through a pullup resistor; the minimum value of the resistor is determined by the current-sinking capability of the driver.

Please be aware that an important notice concerning availability, standard warranty, and use in critical applications of Texas Instruments semiconductor products and disclaimers thereto appears at the end of this data sheet.

PRODUCTION DATA information is current as of publication date. Products conform to specifications per the terms of Texas Instruments standard warranty. Production processing does not necessarily include testing of all parameters.

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On products compliant to MIL-PRF-38535, all parameters are tested unless otherwise noted. On all other products, production processing does not necessarily include testing of all parameters.

ORDERING INFORMATION

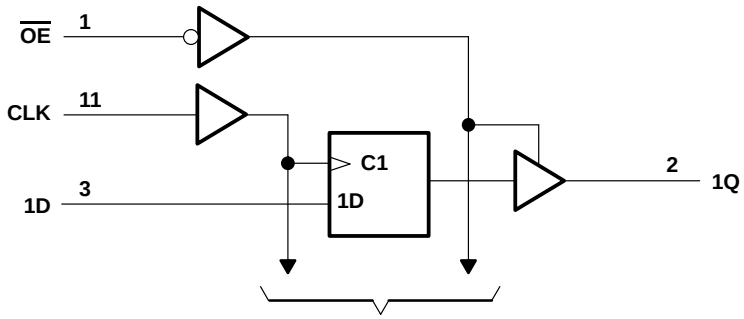
T_A	PACKAGE†		ORDERABLE PART NUMBER	TOP-SIDE MARKING
–40°C to 85°C	PDIP – N	Tube	SN74AHC374N	SN74AHC374N
	SOIC – DW	Tube	SN74AHC374DW	AHC374
		Tape and reel	SN74AHC374DWR	
	SOP – NS	Tape and reel	SN74AHC374NSR	AHC374
	SSOP – DB	Tape and reel	SN74AHC374DBR	HA374
	TSSOP – PW	Tape and reel	SN74AHC374PWR	HA374
	TVSOP – DGV	Tape and reel	SN74AHC374DGVR	HA374
–55°C to 125°C	CDIP – J	Tube	SNJ54AHC374J	SNJ54AHC374J
	CFP – W	Tube	SNJ54AHC374W	SNJ54AHC374W
	LCCC – FK	Tube	SNJ54AHC374FK	SNJ54AHC374FK

† Package drawings, standard packing quantities, thermal data, symbolization, and PCB design guidelines are available at www.ti.com/sc/package.

FUNCTION TABLE
(each flip-flop)

INPUTS			OUTPUT
$\overline{OE}$	CLK	D	Q
L	↑	H	H
L	↑	L	L
L	H or L	X	Q_0
H	X	X	Z

logic diagram (positive logic)



absolute maximum ratings over operating free-air temperature range (unless otherwise noted)†

Supply voltage range, V_{CC} . . . . . –0.5 V to 7 V
Input voltage range, V_I (see Note 1) . . . . . –0.5 V to 7 V
Output voltage range, V_O (see Note 1) . . . . . –0.5 V to V_{CC} + 0.5 V
Input clamp current, I_{IK} (V_I < 0) . . . . . –20 mA
Output clamp current, I_{OK} (V_O < 0 or V_O > V_{CC}) . . . . . ±20 mA
Continuous output current, I_O (V_O = 0 to V_{CC}) . . . . . ±25 mA
Continuous current through V_{CC} or GND . . . . . ±75 mA
Package thermal impedance, θ_{JA} (see Note 2): DB package . . . . . 70°C/W
DGV package . . . . . 92°C/W
DW package . . . . . 58°C/W
N package . . . . . 69°C/W
NS package . . . . . 60°C/W
PW package . . . . . 83°C/W
Storage temperature range, T_{stg} . . . . . –65°C to 150°C

† Stresses beyond those listed under "absolute maximum ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated under "recommended operating conditions" is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.

NOTES: 1. The input and output voltage ratings may be exceeded if the input and output current ratings are observed.
2. The package thermal impedance is calculated in accordance with JESD 51-7.

recommended operating conditions (see Note 3)

			SN54AHC374		SN74AHC374		UNIT
			MIN	MAX	MIN	MAX	
V_{CC}	Supply voltage		2	5.5	2	5.5	V
V_{IH}	High-level input voltage	V_{CC} = 2 V	1.5		1.5		V
		V_{CC} = 3 V	2.1		2.1		
		V_{CC} = 5.5 V	3.85		3.85		
V_{IL}	Low-level input voltage	V_{CC} = 2 V		0.5		0.5	V
		V_{CC} = 3 V		0.9		0.9	
		V_{CC} = 5.5 V		1.65		1.65	
V_I	Input voltage		0	5.5	0	5.5	V
V_O	Output voltage		0	V_{CC}	0	V_{CC}	V
I_{OH}	High-level output current	V_{CC} = 2 V		–50		–50	μA
		V_{CC} = 3.3 V ± 0.3 V		–4		–4	mA
		V_{CC} = 5 V ± 0.5 V		–8		–8	
I_{OL}	Low-level output current	V_{CC} = 2 V		50		50	μA
		V_{CC} = 3.3 V ± 0.3 V		4		4	mA
		V_{CC} = 5 V ± 0.5 V		8		8	
$\Delta t/\Delta v$	Input transition rise or fall rate	V_{CC} = 3.3 V ± 0.3 V		100		100	ns/V
		V_{CC} = 5 V ± 0.5 V		20		20	
T_A	Operating free-air temperature		–55	125	–40	85	°C

NOTE 3: All unused inputs of the device must be held at V_{CC} or GND to ensure proper device operation. Refer to the TI application report, *Implications of Slow or Floating CMOS Inputs*, literature number SCBA004.

electrical characteristics over recommended operating free-air temperature range (unless otherwise noted)

PARAMETER	TEST CONDITIONS	V_{CC}	T_A = 25°C			SN54AHC374		SN74AHC374		UNIT
			MIN	TYP	MAX	MIN	MAX	MIN	MAX	
V_{OH}	I_{OH} = –50 μA	2 V	1.9	2		1.9		1.9		V
		3 V	2.9	3		2.9		2.9		
		4.5 V	4.4	4.5		4.4		4.4		
	I_{OH} = –4 mA	3 V	2.58			2.48		2.48		
	I_{OH} = –8 mA	4.5 V	3.94			3.8		3.8		
V_{OL}	I_{OL} = 50 μA	2 V			0.1		0.1		0.1	V
		3 V			0.1		0.1		0.1	
		4.5 V			0.1		0.1		0.1	
	I_{OL} = 4 mA	3 V			0.36		0.5		0.44	
	I_{OL} = 8 mA	4.5 V			0.36		0.5		0.44	
I_I	V_I = 5.5 V or GND	0 V to 5.5 V			±0.1		±1*		±1	μA
I_{OZ}	V_O = V_{CC} or GND	5.5 V			±0.25		±2.5		±2.5	μA
I_{CC}	V_I = V_{CC} or GND, I_O = 0	5.5 V			4		40		40	μA
C_i	V_I = V_{CC} or GND	5 V		4	10				10	pF
C_o	V_O = V_{CC} or GND	5 V		6						pF

* On products compliant to MIL-PRF-38535, this parameter is not production tested at V_{CC} = 0 V.

timing requirements over recommended operating free-air temperature range, V_{CC} = 3.3 V ± 0.3 V (unless otherwise noted) (see Figure 1)

		T_A = 25°C		SN54AHC374		SN74AHC374		UNIT
		MIN	MAX	MIN	MAX	MIN	MAX	
t_w	Pulse duration, CLK high or low	5		5.5		5.5		ns
t_{su}	Setup time, data before CLK↑	4.5		4		4		ns
t_h	Hold time, data after CLK↑	2		2		2		ns

timing requirements over recommended operating free-air temperature range, V_{CC} = 5 V ± 0.5 V (unless otherwise noted) (see Figure 1)

		T_A = 25°C		SN54AHC374		SN74AHC374		UNIT
		MIN	MAX	MIN	MAX	MIN	MAX	
t_w	Pulse duration, CLK high or low	5		5		5		ns
t_{su}	Setup time, data before CLK↑	3		3		3		ns
t_h	Hold time, data after CLK↑	2		2		2		ns

switching characteristics over recommended operating free-air temperature range, V_{CC} = 3.3 V ± 0.3 V (unless otherwise noted) (see Figure 1)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	LOAD CAPACITANCE	T_A = 25°C			SN54AHC374		SN74AHC374		UNIT
				MIN	TYP	MAX	MIN	MAX	MIN	MAX	
f_{max}			C_L = 15 pF	80*	130*		70*		70		MHz
			C_L = 50 pF	55	85		50		50		
t_{PLH}	CLK	Q	C_L = 15 pF		8.1*	12.7*	1*	15*	1	15	ns
t_{PHL}					8.1*	12.7*	1*	15*	1	15	
t_{PZH}	$\overline{OE}$	Q	C_L = 15 pF		7.1*	11*	1*	13*	1	13	ns
t_{PZL}					7.1*	11*	1*	13*	1	13	
t_{PHZ}	$\overline{OE}$	Q	C_L = 15 pF		7.5*	10.5*	1*	12.5*	1	12.5	ns
t_{PLZ}					7.5*	10.5*	1*	12.5*	1	12.5	
t_{PLH}	CLK	Q	C_L = 50 pF		10.6	16.2	1	18.5	1	18.5	ns
t_{PHL}					10.6	16.2	1	18.5	1	18.5	
t_{PZH}	$\overline{OE}$	Q	C_L = 50 pF		9.6	14.5	1	16.5	1	16.5	ns
t_{PZL}					9.6	14.5	1	16.5	1	16.5	
t_{PHZ}	$\overline{OE}$	Q	C_L = 50 pF		10.2	14	1	16	1	16	ns
t_{PLZ}					10.2	14	1	16	1	16	
$t_{sk(o)}$			C_L = 50 pF			1.5**				1.5	ns

* On products compliant to MIL-PRF-38535, this parameter is not production tested.
** On products compliant to MIL-PRF-38535, this parameter does not apply.

switching characteristics over recommended operating free-air temperature range, V_{CC} = 5 V ± 0.5 V (unless otherwise noted) (see Figure 1)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	LOAD CAPACITANCE	T_A = 25°C			SN54AHC374		SN74AHC374		UNIT
				MIN	TYP	MAX	MIN	MAX	MIN	MAX	
f_{max}			C_L = 15 pF	130*	185*		110*		110		MHz
			C_L = 50 pF	85	120		75		75		
t_{PLH}	CLK	Q	C_L = 15 pF		5.4*	8.1*	1*	9.5*	1	9.5	ns
t_{PHL}					5.4*	8.1*	1*	9.5*	1	9.5	
t_{PZH}	$\overline{OE}$	Q	C_L = 15 pF		5.1*	7.6*	1*	9*	1	9	ns
t_{PZL}					5.1*	7.6*	1*	9*	1	9	
t_{PHZ}	$\overline{OE}$	Q	C_L = 15 pF		4.6*	6.8*	1*	8*	1	8	ns
t_{PLZ}					4.6*	6.8*	1*	8*	1	8	
t_{PLH}	CLK	Q	C_L = 50 pF		6.9	10.1	1	11.5	1	11.5	ns
t_{PHL}					6.9	10.1	1	11.5	1	11.5	
t_{PZH}	$\overline{OE}$	Q	C_L = 50 pF		6.6	9.6	1	11	1	11	ns
t_{PZL}					6.6	9.6	1	11	1	11	
t_{PHZ}	$\overline{OE}$	Q	C_L = 50 pF		6.1	8.8	1	10	1	10	ns
t_{PLZ}					6.1	8.8	1	10	1	10	
$t_{sk(o)}$			C_L = 50 pF			1**				1	ns

* On products compliant to MIL-PRF-38535, this parameter is not production tested.
** On products compliant to MIL-PRF-38535, this parameter does not apply.

noise characteristics, V_{CC} = 5 V, C_L = 50 pF, T_A = 25°C (see Note 4)

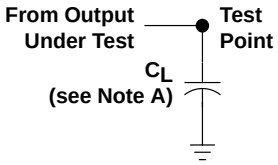
PARAMETER		SN74AHC374			UNIT
		MIN	TYP	MAX	
$V_{OL(P)}$	Quiet output, maximum dynamic V_{OL}		0.5	1	V
$V_{OL(V)}$	Quiet output, minimum dynamic V_{OL}		–0.5	–0.8	V
$V_{OH(V)}$	Quiet output, minimum dynamic V_{OH}	4			V
$V_{IH(D)}$	High-level dynamic input voltage	3.5			V
$V_{IL(D)}$	Low-level dynamic input voltage			1.5	V

NOTE 4: Characteristics are for surface-mount packages only.

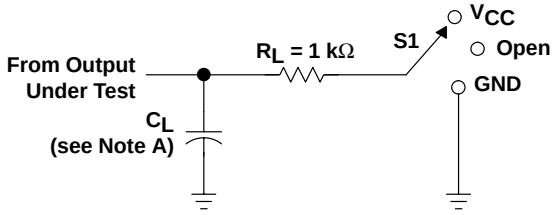
operating characteristics, V_{CC} = 5 V, T_A = 25°C

PARAMETER		TEST CONDITIONS	TYP	UNIT
C_{pd}	Power dissipation capacitance	No load, f = 1 MHz	32	pF

PARAMETER MEASUREMENT INFORMATION

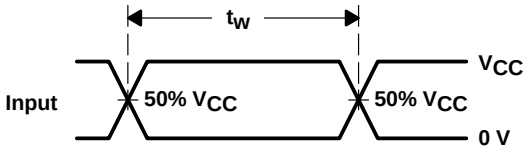


LOAD CIRCUIT FOR
TOTEM-POLE OUTPUTS

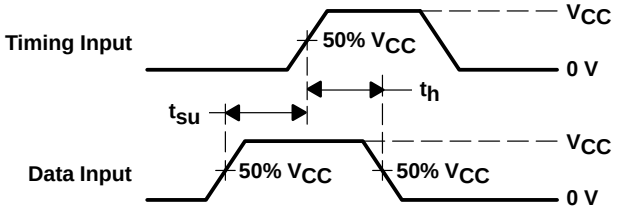


TEST	S1
t_{PLH}/t_{PHL}	Open
t_{PLZ}/t_{PZL}	V_{CC}
t_{PHZ}/t_{PZH}	GND
Open Drain	V_{CC}

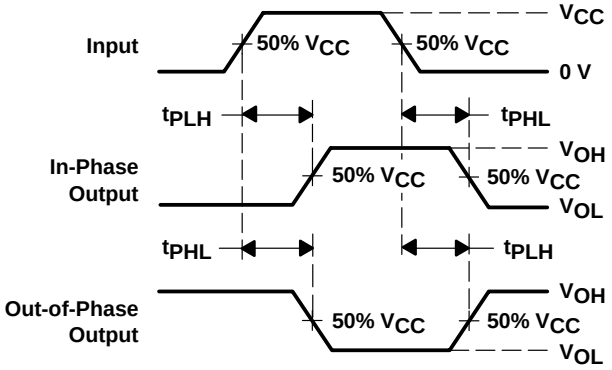
LOAD CIRCUIT FOR
3-STATE AND OPEN-DRAIN OUTPUTS



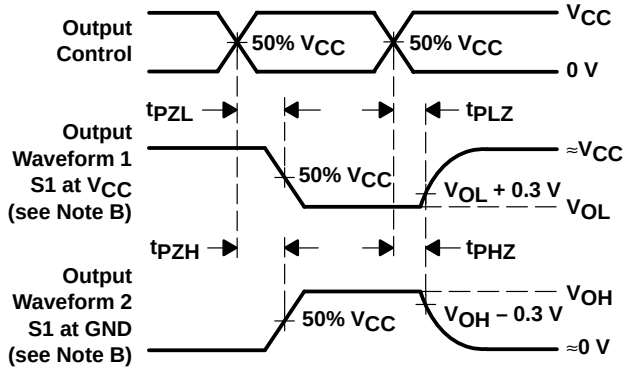
VOLTAGE WAVEFORMS
PULSE DURATION



VOLTAGE WAVEFORMS
SETUP AND HOLD TIMES



VOLTAGE WAVEFORMS
PROPAGATION DELAY TIMES
INVERTING AND NONINVERTING OUTPUTS



VOLTAGE WAVEFORMS
ENABLE AND DISABLE TIMES
LOW- AND HIGH-LEVEL ENABLING

NOTES: A. C_L includes probe and jig capacitance.
B. Waveform 1 is for an output with internal conditions such that the output is low except when disabled by the output control. Waveform 2 is for an output with internal conditions such that the output is high except when disabled by the output control.
C. All input pulses are supplied by generators having the following characteristics: PRR ≤ 1 MHz, Z_O = 50 Ω, t_r ≤ 3 ns, t_f ≤ 3 ns.
D. The outputs are measured one at a time with one input transition per measurement.

Figure 1. Load Circuit and Voltage Waveforms

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